

SHDSL 2-Wire/4-Wire NTU Product Series Installation and Maintenance Practice

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1. GENERAL

This practice is an installation and maintenance guide for the ADTRAN® SHDSL 2-Wire/4-Wire NTU Product Series. This series includes the modules listed in [Table 1](#).

Table 1. SHDSL 2W/4W NTU Products

Part Number	Product Name	Powering
1230001L1	Express 6540	AC
1230002L1	Express 6540	DC
1230007L1	Express 6541	AC
1230008L1	Express 6541	DC
1230009L1	Express 6542 E1 SPN	Span or DC

Note: The Express 6540 and Express 6541 model sets are separate AC or DC powered versions of the same base product (e.g. P/Ns 1230001 and 1230002; 1230007 and 1230008).

Revision History

This is the second issue of this practice. Modifications to product features are included in this issue.

Description

The SHDSL 2W4W NTU provides an interface between the SHDSL network and the user's Data Terminal Equipment (DTE), for applications such as LAN-to-LAN bridging, Frame Relay circuit and PABX termination. The NTU operates in two different system configurations:

- As a remote unit to the ADTRAN Total Access® 3000 (see [Figure 1](#)).
- In pairs in a point-to-point limited distance campus configuration, with one NTU configured to "LT" mode (see [Figure 2](#)).

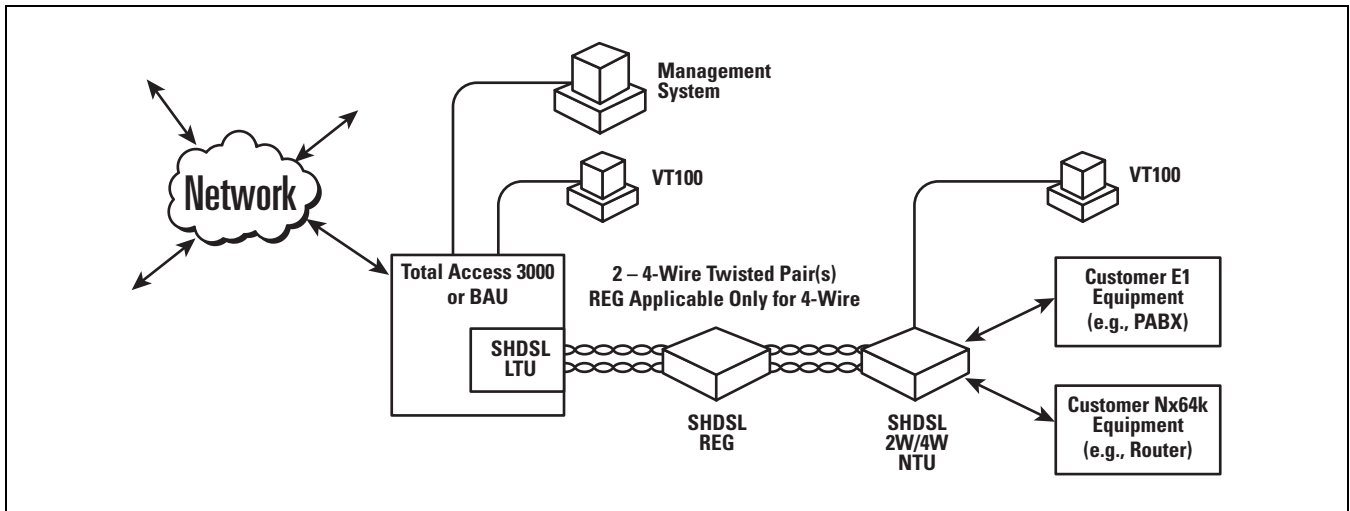


Figure 1. Typical System Application

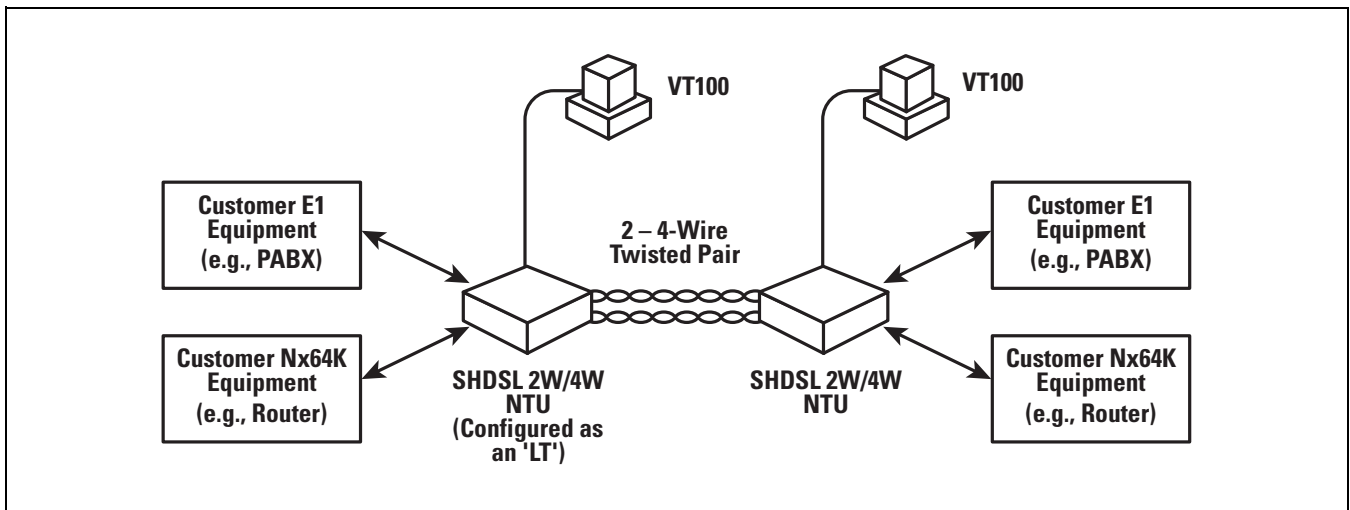


Figure 2. Typical Campus Application

SHDSL 2-Wire/4-Wire Mode, Line Rate

The NTU supports multi-rate line operation as shown in [Table 2](#).

Table 2. 2W/4W Multi-Rate Operation

Data Rate Type	2-Wire Mode	4-Wire Mode
SHDSL Line Aggregate Data Rate	200 kbps to 2.312 Mbps ($N \times 64 \text{ kbps} + 8 \text{ kbps}$, where $N = 3$ to 36). In 2-wire mode, 8 kbps of bandwidth is required for overhead framing	400 kbps to 4.624 Mbps ($N \times 64 \text{ kbps} + 16 \text{ kbps}$, where $N = 6$ to 72). In 4-wire mode, 16 kbps is required for overhead framing.
Payload Data Rate	192 kbps to 2.304 Mbps ($N \times 64 \text{ kbps}$, where $N = 3$ to 36) or 384 kbps to 4.608 Mbps.	$(2 \times N \times 64 \text{ kbps})$, where $N = 3$ to 36)
Service Data Rate	64 kbps to 2.304 Mbps ($N \times 64 \text{ kbps}$, where $N = 1$ to 36) or 64 kbps to 4.608 Mbps	$(N \times 64 \text{ kbps})$, where $N = 1$ to 72). This is the actual user data rate delivered to either the G.703 or Nx64 kbps ports.

Features

Table 3 is a matrix of product features for the five versions of the SHDSL 2W/4W NTU in this Practice.

Table 3. Product Feature Set Matrix

			Model Number				
			1230001L1	1230002L1	1230007L1	1230008L1	1230009L1
Physical Description							
Net Housing: 5.3 cm (2.1 in.) H x 23.6 cm (9.3 in.) W x 16.8 cm (6.6 in.) D			•	•	•	•	•
Front Panel Recessed Pushbuttons (4 total)							
PORT SELECT			•	•	•	•	•
LOCAL LOOP/ERR INJ			•	•	•	•	•
REMOTE LOOP			•	•	•	•	•
BERT			•	•	•	•	•
Front Panel Tri-Color LED Indicators (always 8 total)							
Left to Right Order	Label	Function					
LED 1	SHDSL	SHDSL Port Status, Test Select, Alarms	•	•	•	•	
LED 2	G.703	G.703 Port Status, Test Select, Alarms	•	•	•	•	
LED 3	Nx64k	Nx64k Port Status, Test Select, Alarms	•	•	•	•	
	SPN PWR	Span Power Status					•
LED 4	RTS/C	Nx64k Port TRTS/C Status	•	•	•	•	
	DC PWR	Local DC Power Status					•
LED 5	RLSD/I	Nx64k Port RLSD/I Status	•	•	•	•	
	PRGM	Firmware Programming Status					•
LED 6	LLOOP	Local loopback test status for selected port	•	•	•	•	•
LED 7	RLOOP	Remote loopback test status for selected port	•	•	•	•	•
LED 8	BERT	BERT for selected port/service	•	•	•	•	•
Rear Panel							
SHDSL Port (RJ-45 135 ohms, TNV-3 rated)			•	•	•	•	•
G.703 E1 Port (RJ-45 120 ohms, SELV rated)			•	•			•
Optional G.703 E1 Port (RJ-45 to BNC 75 ohms via external adapter, ADTRAN P/N 1225002L1)			•	•			•
G.703 E1 Port (BNC, 75 ohms, SELV rated)			•	•	•	•	•
Nx64k Port X.21 (DB-15 female / ISO 4903, SELV; V.11 electrical)			•	•	•	•	
Nx64k Port V.35 (M34 Winchester 34-pin female / ISO 2593, SELV rated; V.35, V.28 electrical)			•	•	•	•	
Nx64k Port V.36 using the V.35 (34-pin male) to V.36 (ISO 4902 37-pin female) 12 inch adapter cable, ADTRAN P/N 1225004L1; V.11, V.10 electrical			•	•	•	•	
Local Management Port (DB-9 female, SELV; V.28 electrical)			•	•	•	•	
AC Power (IEC-320 power receptacle)			•	•	•	•	•
DC Power (5.08 mm (0.2 inc.) 4-pin terminal block shrouded male (MOLEX/BEAU 861904 or equivalent)				•		•	•
Power							
100-240 VAC, 50/60Hz, 100 mA			•		•	•	
35-80 VDC, 250 mA				•			
120 VDC Span Powered, 150 mA							
120 VDC Span Powered, 150 mA; 35-80 VDC, 250 mA Auto-Switched Local Powered							•

Compliance

The SHDSL 2-Wire/4-Wire NTU Product Series complies with the following international standards:

- EN 300 386-2
- IEC 60950/EN 60950/AS NZS60950
- S016
- S043.2
- ITU K.21 Enhanced
- Telstra 1555

Figure 3 shows the compliance code label for the SHDSL 2-Wire/4-Wire NTU Product Series.

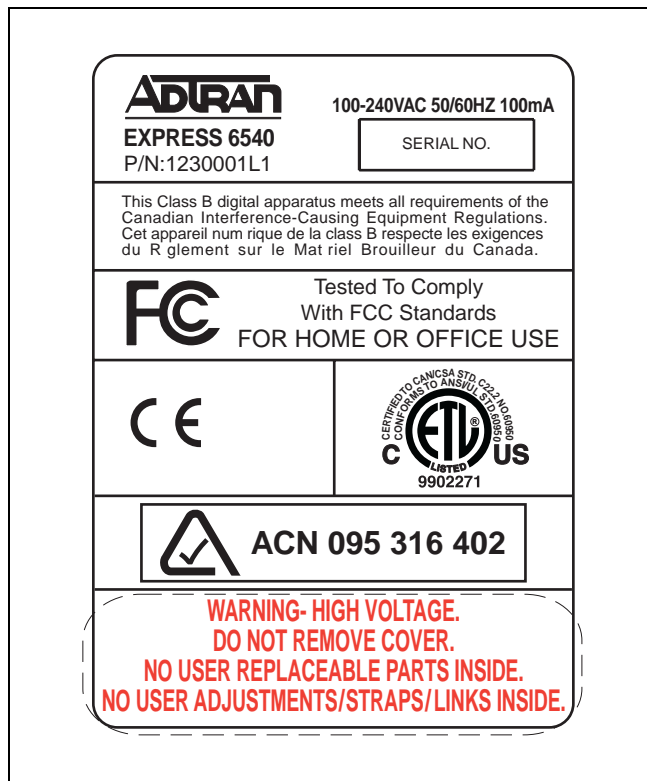


Figure 3. Compliance Label

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by ADTRAN could void the user's authority to operate this equipment.

2. INSTALLATION



After unpacking any of the SHDSL 2-Wire/4-Wire NTU Product Series, inspect for damage. If damage has occurred, file a claim with the carrier, then contact ADTRAN Customer Service. Refer to the [Warranty and Customer Service](#) section for further information. If possible, keep the original shipping container for returning the unit for repair or for verification of shipping damage.

Shipping Contents

The contents include the following items:

- For AC models, an IEC-320 female to Australian male, 6-foot AC power cable, ADTRAN P/N 3127052
- For DC models, a mating quick-connect terminal screw block
- RJ-45 male to RJ-45 male straight-through CAT5-equivalent 6-foot SHDSL network cable, ADTRAN P/N 3127026
- User reference card with supplemental information to bottom housing label
- SHDSL 2-Wire/4-Wire NTU Job Aid

Front Panel Pushbuttons

There are four pushbuttons on the SHDSL 2W/4W NTU front panel that are labeled and operate per [Table 4](#). The pushbuttons have been recessed to avoid accidental actuation and can be disabled via the management interface either as a group or individually.

Front Panel LEDs

The front panel has tri-color LED status indicators that match the model's specific feature set. The LED configuration for each product in the series is shown in [Table 3](#) on page 3. LED functionality is detailed in [Table 5](#).

[Figure 4](#) and [Figure 5](#) illustrate the two possible front panel configurations.

Table 4. Pushbutton Functionality

Pushbutton	Description
PORT SELECT	Pressing the SELECT button will sequentially select active ports in the following order: Nx64K port (all units except 1230009L1), G.703 port, SHDSL port, and then cycle back to “No Port.”
LOCAL LOOP / ERR INJ	If a port is selected, and a BERT (Bit Error Rate Test) is not in progress, then pressing the button will initiate/terminate a local loop on the selected port. If a BERT is in progress, then pressing the button injects a single bit error.
REMOTE LOOP	If the SHDSL port is selected, then pressing the button either places or removes a remote loop on the port by sending a EOC request message to the STU-C (or STU-R in campus mode). If the Nx64K port or G.703 port (with only one service defined) is selected, then pressing the button will place or remove a remote loop on the selected port's single data service by sending respective inband loop up or loop down patterns to the far end (in the associated data service timeslots).
BERT	If a port is selected, and there are no local loops, then pressing the button starts or stop a BERT on the selected port.

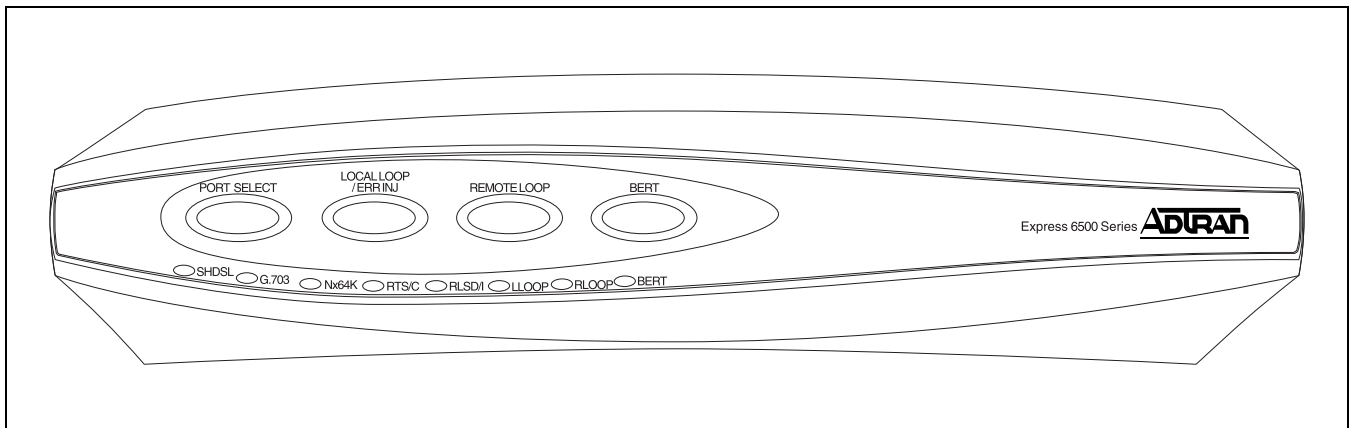


Figure 4. Front Panel for 6540 and 6541 Models

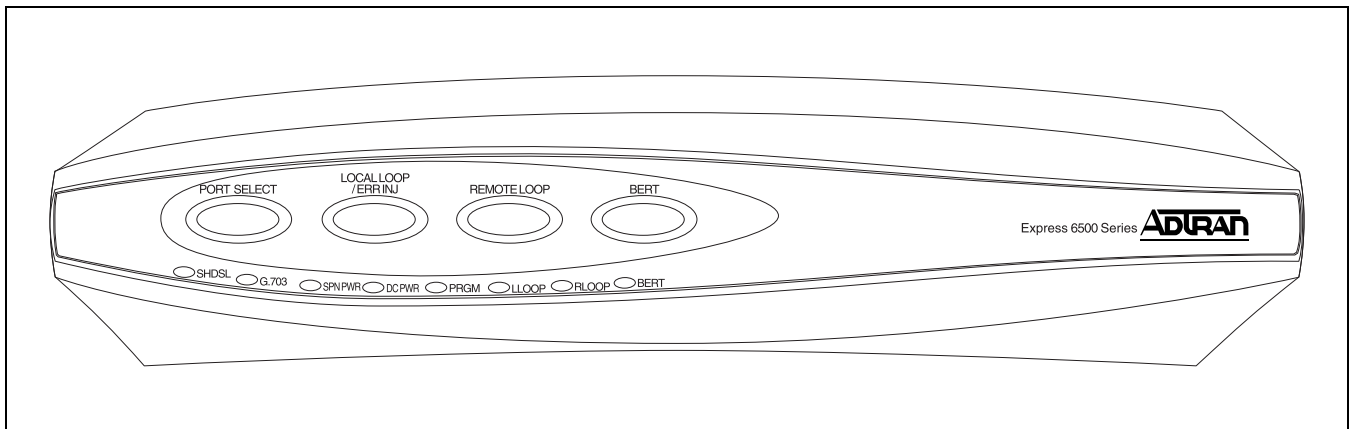


Figure 5. Front Panel for 6542 Model

Table 5. LED Indicator Functionality

LED	Off	Green	Yellow	Red
SHDSL	Unit is powered off.	Port is trained with no active alarm condition.	Port is trained with minor active alarm condition. ¹	Port is attempting to train or is trained with a major active alarm condition. ²
G.703	Port is not active.	Port is active with no active alarm condition.	Port is active with a minor alarm condition. ³	Port is active with a major active alarm condition. ⁴
Nx64K	Port is not active.	Port is active with no active alarm condition.	N/A	Port is active with an active alarm condition. ⁵
RTS/C	Nx64K port is not active or when active, V.35/V.36 “Request To Send” or X.21 “Control” line from the DTE is OFF.	V.35/V.36 “Request To Send” or X.21 “Control” line from the DTE is ON.	N/A	N/A
RLSD/I	Nx64K port is not active or when active, V.35/V.36 “Receive Line Signal Detector” and X.21 “Indication” control line from the NTU (DCE) is OFF.	V.35/V.36 “Receive Line Signal Detector” or X.21 “Indication” control line from the NTU (DCE) is ON.	N/A	N/A
LLOOP	No Local Loop is active.	N/A	A Local Loopback is active on the selected port.	A Local Loop is active on one or more ports or services (when no port is selected).
RLOOP	No Remote Loop is active.	N/A	A Remote Loopback is active on the selected port (when it is possible to determine via an established EOC).	A Remote Loop is active on one or more ports or services (when no port is selected).
BERT	BERT is not active.	A BERT is active, and the test pattern detector is synchronized with no received bit errors.	A BERT is active, and one or more test pattern bit errors have been received.	BERT is active, but the test pattern detector is not synchronized.
SPN PWR	Unit is not SHDSL span powered	Unit is SHDSL span powered	N/A	N/A
DC PWR	Unit is not locally DC powered	Unit is locally DC powered	N/A	N/A
PRGM	Firmware is not being programmed	Local unit firmware is being locally programmed	Remote unit firmware is being locally programmed	Local unit firmware is being remotely programmed

¹ Minor SHDSL port alarms are CRC errors, Loop Attenuation Threshold Alarm, SNR Margin Threshold Alarm, Segment Anomaly, and any ES, SES, UAS, CVC, and LOSWS 15-Minute Threshold Alarm.

² Major SHDSL port alarms are LOS, LOSW, or Segment Defect.

³ Minor G.703 port alarms are Rx RAI, Frame Slip, CRC-4 errors, LBER, and any ES, SES, UAS, and CVC 15-Minute Threshold Alarm.

⁴ Major G.703 port alarms are LOS, LOF, LOMF, Rx AIS, or HBER.

⁵ Nx64K port Alarms are Clock Slip, Loss of External Clock, FIFO Underflow/Overflow, and Inactivity Alarm.

Pushbutton and LED Indicator Interaction

The following is further explanation of the required interaction between the front panel pushbuttons and LED's.

When no port has been selected, (no flashing port LEDs) then only the **PORT SELECT** pushbutton will be enabled, and the **LLOOP**, **RLOOP**, and **BERT** LED's will indicate as shown in [Table 6](#).

Table 6. LED Indication - No Port Selected

Test	Description
SHDSL, G.703, or Nx64k interface test condition active	LED will be on
No interface test condition active	LED will be off

When the **PORT SELECT** pushbutton is first pressed, the **Nx64K** LED will flash (if the model has an active Nx64K port) to indicate that the Nx64K port has been selected. The **LLOOP**, **RLOOP**, and **BERT** LED's will indicate the state of tests only on the Nx64K port. Additionally, the **LLOOP**, **RLOOP**, and **BERT** pushbuttons will initiate/terminate tests only on the Nx64K port.

When the **PORT SELECT** pushbutton is again pressed, the G.703 LED will flash (if the model has an active G.703 port) to indicate that the G.703 port has been selected. The **LLOOP**, **RLOOP**, and **BERT** LED's will indicate the state of tests only on the G.703 port.

If there is only a single service on the G.703 port, then the **LLOOP**, **RLOOP**, and **BERT** pushbuttons will initiate/terminate tests only on this G.703 service. If there are multiple G.703 services on the G.703 port, then the **LLOOP**, **RLOOP**, and **BERT** pushbuttons will be disabled, and the **LLOOP**, **RLOOP**, and **BERT** LED's will indicate per [Table 7](#) one of the following concerning all services using the G.703 port.

Table 7. LED Indication - G.703 Port Services

Test	Description
One or more G.703 service test conditions active	LED will be on
No Service test condition active	LED will be off

When the **PORT SELECT** pushbutton is again pressed, then the **SHDSL** LED will flash (if the SHDSL port pushbutton option is enabled) to indicate that the SHDSL port has been selected. The **LLOOP**, **RLOOP**, and **BERT** LED's will indicate the state of tests on the SHDSL payload.

3. CONNECTIONS

Rear Panel

The NTU does not have a power switch. A rear panel for each model is designed with connections and labeling as per [Table 8](#). [Figure 6](#) through [Figure 10](#) illustrates this information.

Table 8. Rear Panel Connectors

Rear Panel			Model P/N				
Description	Connector(s)	Label	1230001L1	1230002L1	1230007L1	1230008L1	1230009L1
SHDSL Port	RJ-45 (135 ohm; 2-wire or 4-wire)	SHDSL	•	•	•	•	•
G.703 Port	RJ-45 (120 ohm)	G.703	•	•			•
	BNC pair (75 ohm)	G.703; TX, RX			•	•	
Nx64K Port	M34 Winchester 34-pin Female (V.35)	V.35/V.36	•	•	•	•	
	Blank	(none)					•
Management	DB-15 Female (X.21)	X.21	•	•	•	•	
	DB-9 Female (V.28)	Control V.28	•	•	•	•	•
Power	IEC-320 (AC)	100-240VAC 50/60 100mA	•		•		
	Terminal Block (Span or DC)	35-80VDC 250mA		•		•	•

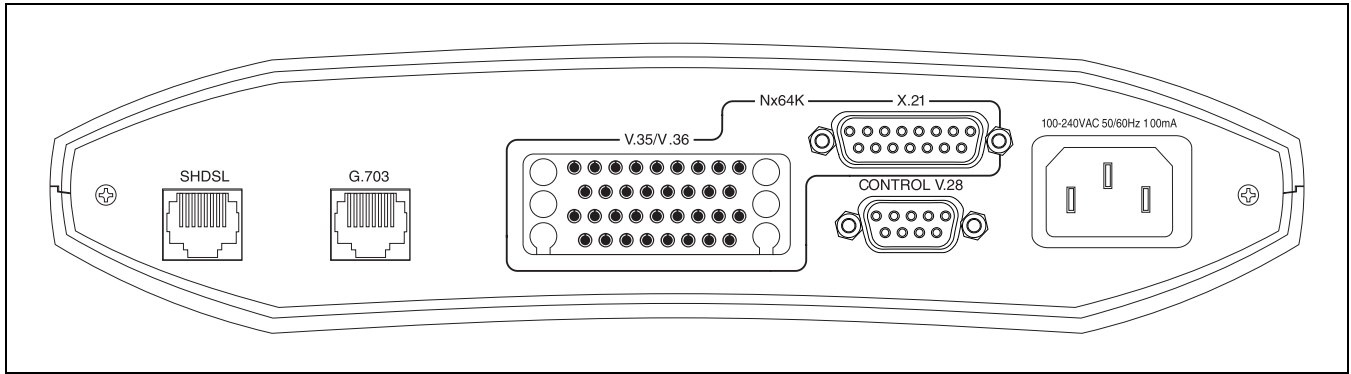


Figure 6. Rear Panel for Model 6540 AC Powered

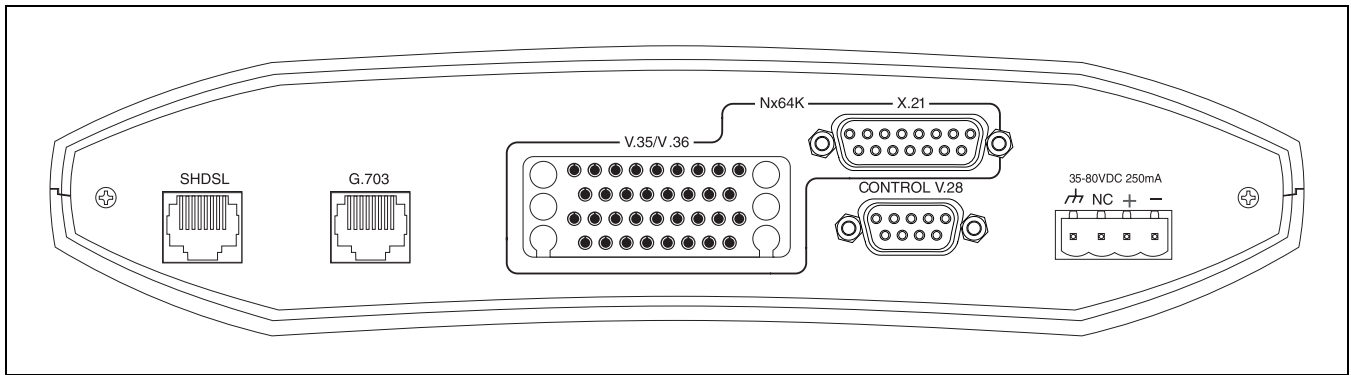


Figure 7. Rear Panel for Model 6540 DC Powered

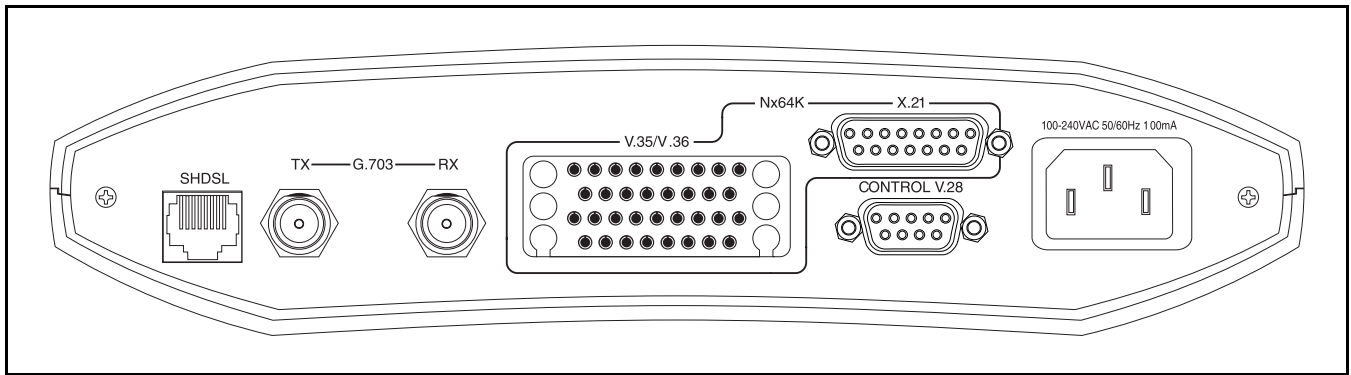


Figure 8. Rear Panel for Model 6541 AC Powered

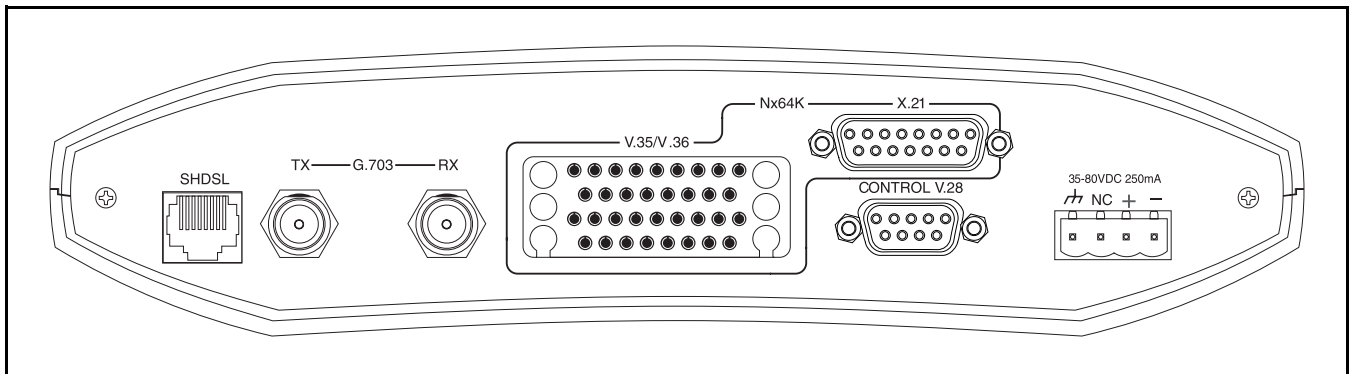


Figure 9. Rear Panel for Model 6541 DC Powered

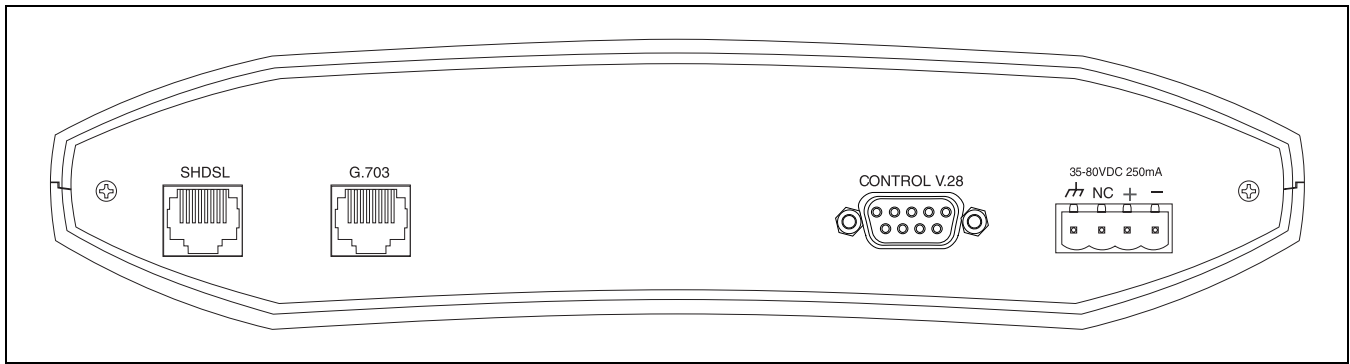


Figure 10. Rear Panel for Model 6542 Span DC Powered

Power Supply

The various models support one of the following power schemes:

- local AC powered only,
- local DC powered only,
- span powered with local DC power auto-switchover.

No adjustments, strapping, or configuration changes are necessary to power the units.

The NTU power supply includes “dying gasp” circuitry that meets the power status bit requirements as specified in ITU-T G.991.2 and for ISDN PRA V3 operation mode.

AC Powering

Physical connection for AC operation will be via an IEC-320 power receptacle. The AC model operates over an AC input range of 90 to 264 VAC (100, 110-120 or 220-240 VAC nominal), 48 to 63 Hz (50 or 60 Hz nominal), and with a power rating not to exceed 7 watts.

DC Powering

Physical connection for DC operation are made on a 4-pin terminal block shrouded-male receptacle. The DC model operates over a DC input range of ± 35 to ± 80 VDC (-48 VDC nominal), with a power rating not to exceed 7 watts. A detachable mating terminal-screw block is supplied separately.

Span Powering

The SHDSL 2W/4W NTU span powered models adhere to sections ITU-T G.991.2 Annex B.5.3 as it applies to STU-Rs.

SHDSL Pinout

The SHDSL port uses a TNV-3 rated, 135W impedance, RJ-45 connection with signals and pinouts as listed in [Table 9](#):

Table 9. SHDSL Port RJ-45 Pinout

Pin	Circuit	
	Name	Function
1	Tip 2	4-wire Loop 2 Pair Tip
2	Ring 2	4-wire Loop 2 Pair Ring
3	NC	Not Connected
4	Tip 1	2-wire Pair Tip, 4-wire Loop 1 Pair Tip
5	Ring 1	2-wire Pair Ring, 4-wire Loop 1 Pair Ring
6 - 8	NC	Not Connected

G.703 Pinout

The G.703 port is SELV rated with a rear panel connection of either a 120 Ω balanced RJ-45 jack with signals and pinouts per [Table 10](#) or a TX/RX pair of 75 Ω balanced or unbalanced BNC connectors, depending on specific model.

Table 10. G.703 Port RJ-45 Pinout

Pin	Circuit	
	Name	Function
1	RX Ring	Receive Pair Ring
2	RX Tip	Receive Pair Transmit
3	RX Shield	Receive Pair Ground Shield
4	TX Ring	Transmit Pair Ring
5	TX Tip	Transmit Pair Tip
6	TX Shield	Transmit Pair Ground Shield
7, 8	NC	Not Connected

Nx64K Port V.35 ISO 2593 34-pin Female Pinout

V.35 Pinout information is detailed in [Table 11](#).

Table 11. Nx64k Port V.35 34-Pin Pinout

V.35 (M34 Winchester) Pin	Interchange Circuit				
	No.	Name	Function	Electrical Characteristics	To/From DCE
A	101	PGND	Protective Ground	–	–
B	102	SGND	Signal Ground	–	–
P	103	TD-A	Transmit Data	V.35	To
S		TD-B			
R	104	RD-A	Receive Data	V.35	From
T		RD-B			
C	105	RTS	Request To Send	V.28	To
D	106	CTS	Clear To Send	V.28	From
E	107	DSR	Data Set Ready	V.28	From
H	108/2	DTR	Data Terminal Ready	V.28	To
F	109	RLSD	Received Line Signal Detect	V.28	From
U	113	ETC-A	Transmit Signal Element Timing	V.35	To
W		ETC-B			
Y	114	TC-A	Transmit Signal Element Timing	V.35	From
AA		TC-B			
V	115	RC-A	Receive Signal Element Timing	V.35	From
X		RC-B			
N	140	RL	Remote Loopback or Loopback/ Maintenance Test	V.28	To
L	141	LL	Local Loopback	V.28	To
NN	142	TI	Test Indicator	V.28	From
B, J, K, M, Z, BB, CC, DD, EE, FF, HH, JJ, KK, LL, MM	–	NC	Not Connected	–	–

V.36 Pinout

The product supports a 37-pin (DB-37) female connection via ADTRAN P/N 1225004L1 12 inch V.35 to V.36 adapter cable that complies to ISO 4902 pinouts. This cable connects to the NTU rear panel V.35

M34 Winchester female connector and provides ID pins to automatically set the Nx64K type to V.36. See [Table 12](#) for the V.35 to V.36 Adapter Cable pinouts.

Table 12. V.35 to V.36 Adapter Cable Pinout

V.35 (M34 Winchester) Pin	V.36 (DB-37 Female) Pin	Interchange Circuit				
		No.	Name	Function	Electrical Characteristics	To/From DCE
A	1	101 or 102	SHIELD	Cable Shield (Protective or Signal Ground)	–	–
B	19, 37, 20	109, 102a, 102b	SGND	Signal Ground	–	–
P	4	103	TD-A	Transmit Data	V.11	To
S	22		TD-B			
R	6	104	RD-A	Receive Data	V.11	From
T	24		RD-B			
C	7	105	RTS-A	Request To Send	V.10	To
M	25		RTS-B		>10K Ω to SGND	
D	9	106	CTS-A	Clear To Send	V.10	From
FF	27		CTS-B		Tri-state	
E	11	107	DSR-A	Data Set Ready	V.10	From
CC	29		DSR-B		Tri-state	
H	12	108/2	DTR-A	Data Terminal Ready	V.10	To
EE	30		DTR-B		>10K Ω to SGND	
F	13	109	RLSD-A	Received Line Signal Detect	V.10	From
Z	31		RLSD-B		Tri-state	
U	17	113	ETC-A	Transmit Signal Element Timing	V.11	To
W	35		ETC-B			
Y	5	114	TC-A	Transmit Signal Element Timing	V.11	From
AA	23		TC-B			
V	8	115	RC-A	Receive Signal Element Timing	V.11	From
X	26		RC-B			
N	14	140	RL	Remote Loopback or Loopback/Maintenance Test	V.10	To
L	10	141	LL	Local Loopback	V.10	To

Table 12. V.35 to V.36 Adapter Cable Pinout (Continued)

V.35 (M34 Winchester) Pin	V.36 (DB-37 Female) Pin	Interchange Circuit				
		No.	Name	Function	Electrical Characteristics	To/From DCE
NN	18	142	TI	Test Indicator	V.10	From
DD, B	–	–	ID0	Adapter Identifier Bit 0 (= 0, SGND)	–	–
LL	–	–	ID1	Adapter Identifier Bit 1 (= 1, NC)	–	–
MM	–	–	ID2	Adapter Identifier Bit 2 (= 1, NC)	–	–
J, K, BB, HH, JJ, KK	2, 3, 15, 16, 21, 28, 32, 33, 34, 36	–	NC	Not Connected	–	–

X.21 Pinout

The SHDSL 2W4W NTU rear panel provides a 15-pin female connection that complies with ISO 4903 pinouts. The X.21 interface implementation is intended to be for leased lines with no end to end signaling or byte timing. See [Table 12](#) for the X.21 pinouts.

Table 13. X.21 Pinout

X.21 (DB-15 Female) Pin	Interchange Circuit			
	Name	Function	Electrical Characteristics	To/From DCE
8	G	Signal Ground	–	–
15	Ga	DTE Common Return	–	To
2	T-A	Transmit	V.11	To
9	T-B			
4	R-A	Receive	V.11	From
11	R-B			
3	C-A	Control	V.11	To
10	C-B			
5	I-A	Indication	V.11	From
12	I-B			
6	S-A	Signal Element Timing	V.11	From
13	S-B			
7	X-A	DTE Signal Element Timing	V.11	To
14	X-B			

4. OPTIONING

Timeslot Cross-Connect Map

A service is comprised of an arbitrary collection of timeslots from the SHDSL interface that are configured via the management interface. The SHDSL 2-Wire/4-Wire NTU Product Series supports the configuration of multiple services. These services are routed to either the G.703 interface or the Nx64k interface. The SHDSL 2W4W NTU supports simultaneous use of the G.703 interface (for multiple services) and either, but not both, the X.21, V.35, or V.36 Nx64K port interfaces. When there is only a single service from the G.703 interface, then the number of timeslots in that service must be less than or equal to 32. SHDSL timeslots that are not assigned to a service will be considered idled, and contain a fixed bit pattern of All Ones. Idled G.704 framed timeslots contents are determined by a programmable pattern register.

The SHDSL 2-Wire/4-Wire NTU Product Series supports the following interfaces and operation:

- A Nx64K single service interface with a data transmission rate of 64 kbps to 2.304 Mbps in 2-wire mode ($N \times 64$ kbps, where $N = 1$ to 36) or 64 kbps to 4.608 Mbps in 4-wire mode ($N \times 64$ kbps, where $N = 1$ to 72).

- A G.703 interface with G.704 framing, with a single or multiple G.703 services with a data transmission rate from 64 kbps to 1.984 Mbps ($N \times 64$ kbps, where $N = 1$ to 31). G.704 framing may be either passed through delivered to end devices, or generated and terminated locally at the NTU G.703 port. In the former case, G.704 framing must be assigned to SHDSL timeslot 0. In the latter case, no G.704 framing passes across the SHDSL line.
- The G.703 interface with G.704 framing runs over SHDSL in aligned mode and support simultaneous services using the Nx64k port for the second service.
- A G.703 interface without framing, with a single 2.048 Mbps service (32×64 kbps), and therefore the only service configured.

Timeslot Allocation

SHDSL timeslots are individually mapped to the required G.703/G.704 and Nx64k service timeslots on a one-to-one basis. As depicted in [Figure 11](#) and [Figure 12](#), both contiguous and non-contiguous service allocations are allowed, as long as the chronological transmission ordering of timeslots is maintained.

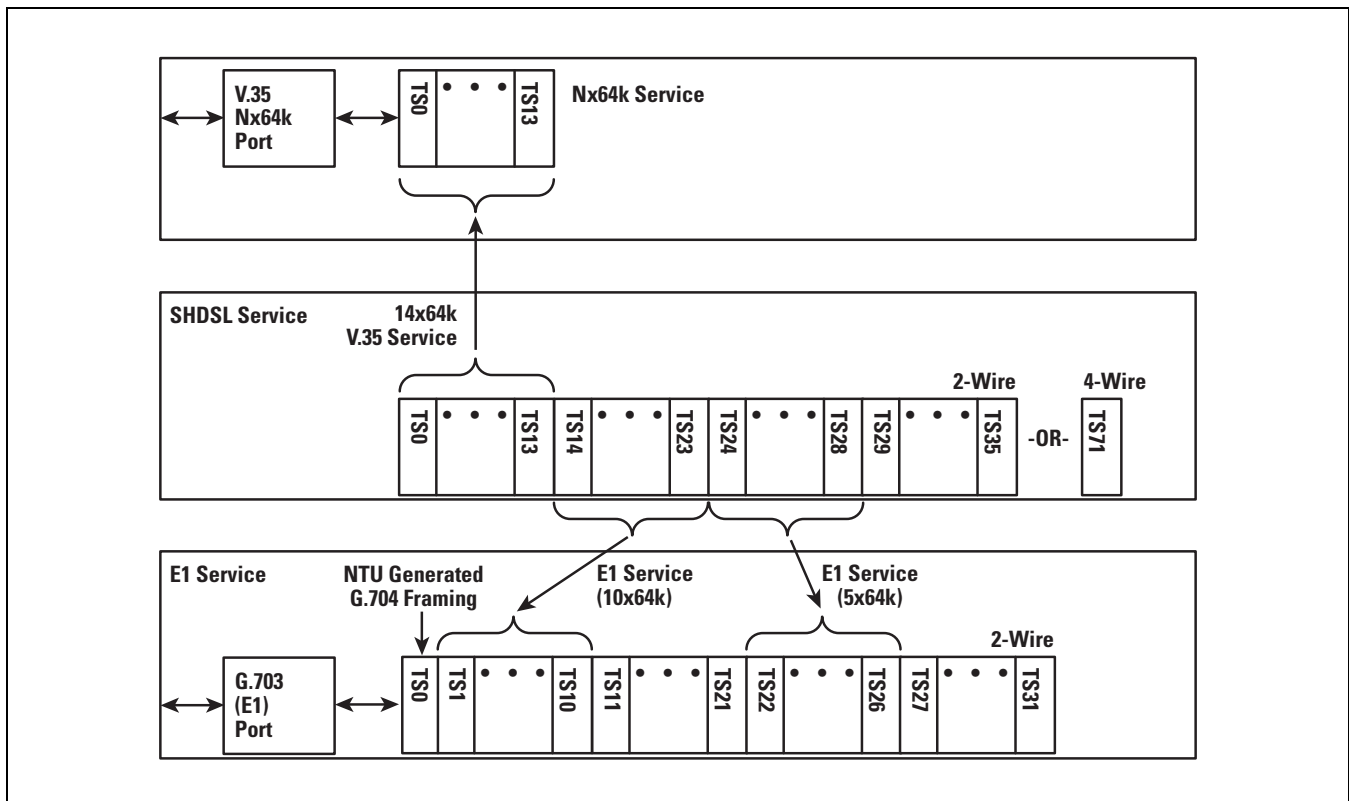


Figure 11. Contiguous Time Slot Allocation

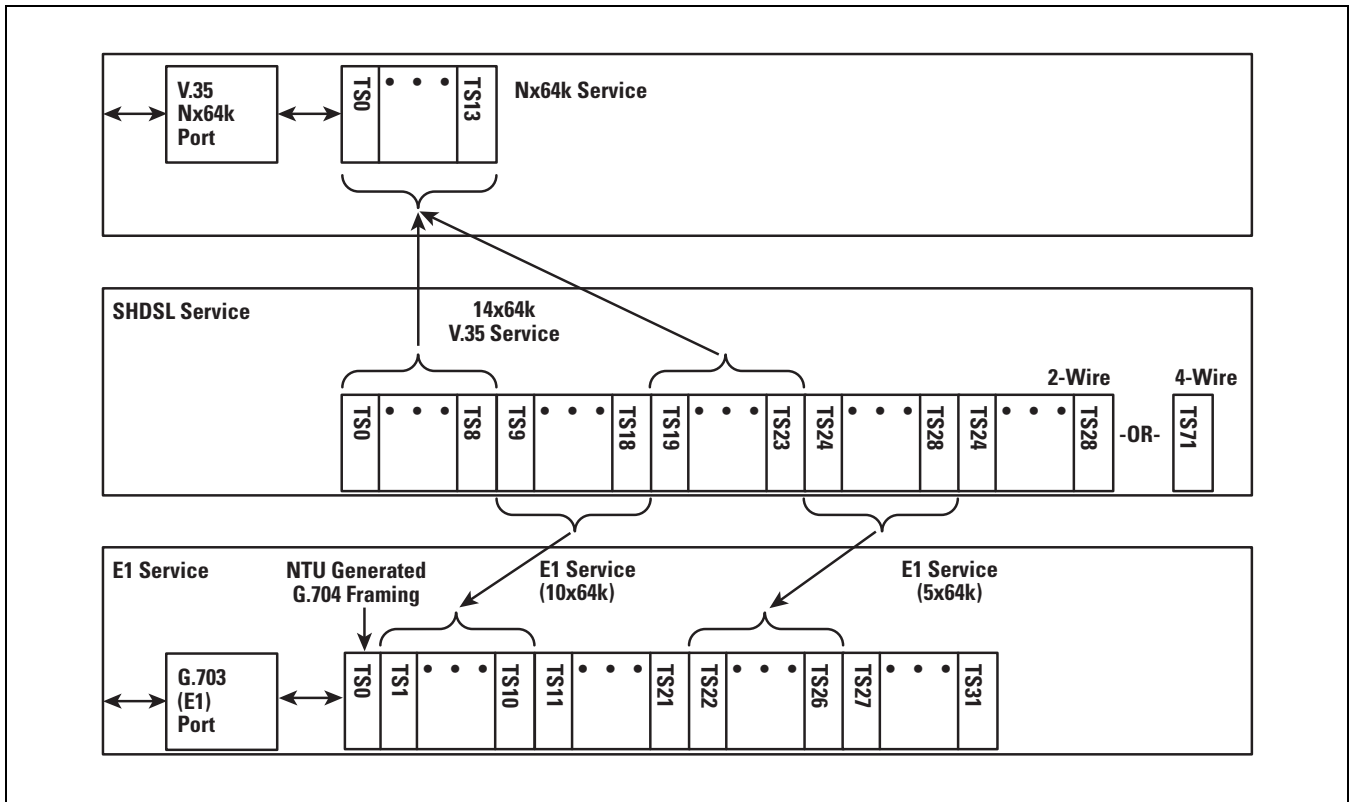


Figure 12. Non-Contiguous Time Slot Allocation

Timing Sources

Transmit and receive clocking is controlled by a configurable option Clk Source which has the following settings:

- Internal Clock (derived from internal oscillator with better than 32 ppm tolerance)
- Nx64k ETC (Nx64k port external transmit clock from DTE, Circuit 113)

- G.703 RX Clock (G.703 port derived receive clock)
- SHDSL RX Clock (SHDSL port derived receive clock)

When in NT mode, interface clock references are always derived from the received SHDSL network signal. When a loss of signal occurs, the transmit timing will be internally loop-timed with a frequency accuracy of ± 32 ppm. See [Figure 13](#).

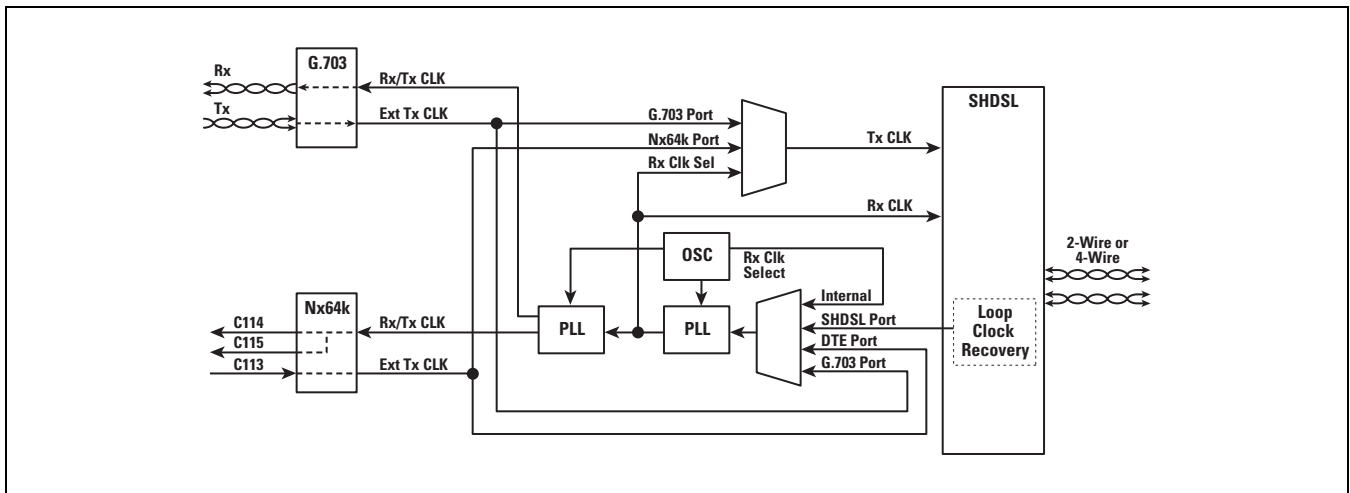


Figure 13. Timing Sources

The 6500 Series Menu Tree is shown in **Figure 14**.

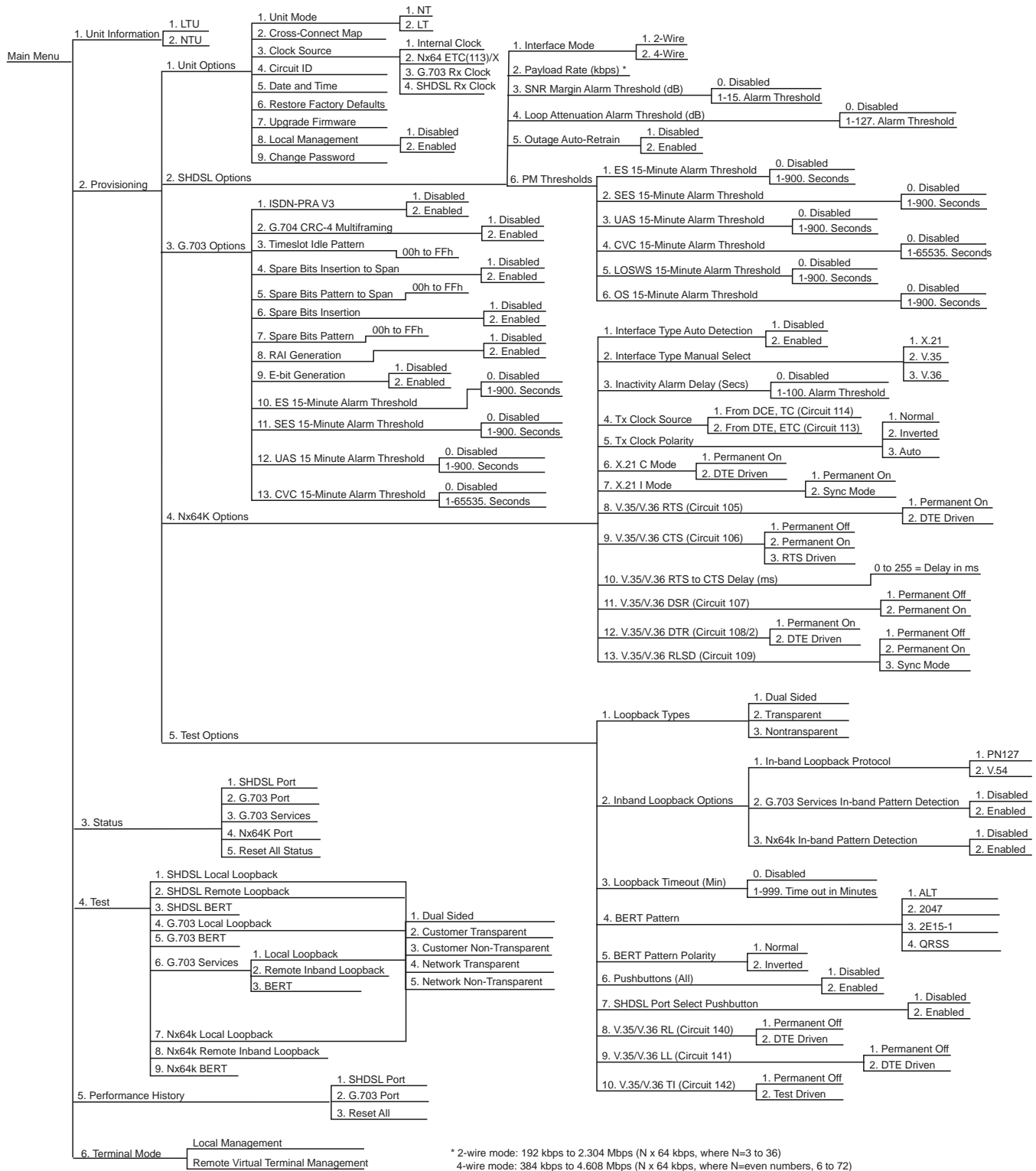


Figure 14. 6500 Series Menu Tree

5. TROUBLESHOOTING

Local and Remote Loopbacks for Ports and Services

For troubleshooting purposes, the SHDSL 2W/4W NTU provides five types of loopback tests for each interface port and each data service.

- Dual sided
- Network transparent
- Network non-transparent
- Customer transparent
- Customer non-transparent.

Loopback tests are initiated from EOC message commands which are initiated in various ways:

- the network management system (NMS)
- local VT100 management screens
- front panel pushbuttons
- the V.35/V.36 RL (Circuit 140) and LL (Circuit 141) control leads
- received V3 command
- generating and detecting inband signaling

The NTU provides an option register for each looping point. The default loopback type is dual-sided. Table specifies the various looping points, originating sources, loopback types, and applicability of the Loopback Type option. VT100 screens, as well as polled EOC status response messages, indicate the active or inactive status of each looping point. If active, the type and originating source of the loopback test is displayed.

The direction of transparent and non-transparent loopbacks depends on the direction of test initiation. For example, if an inband signal was detected on a particular G.703 service having the loopback type option set to transparent, then the received G.703 service data would be looped back to the SHDSL port and also passed through to the G.703 port.

If the SHDSL 2W/4W NTU unit mode is set to NT, this would be labeled as a network transparent loopback. If unit mode is set to LT, and operating in a campus-type application, this would be indicated as a customer transparent loopback. An example of this procedure would be when the Nx64K port loopback type option is set to non-transparent, and the V.35/V.36 LL (Circuit 141) lead is asserted ON, then the received Nx64k data would be looped back to the DTE equipment and an all ones pattern would be sent to the SHDSL port. If that SHDSL 2W/4W NTU is configured as an NTU (or

STU-R) this would be indicated as a customer non-transparent loopback. If configured as an LTU (or STU-C) and operating in a campus-type application, this would be indicated as a network non-transparent loopback.

The initiation or removal of any loopback test will not cause a clock glitch on any interface. Loopbacks may be set by one source and removed by another source. If the SHDSL line were to be dropped or if the NTU is power-cycled, all active loopback tests will be released. See [Table 14](#) for loopback test summary information.

Bit Error Rate Tester (BERT)

The NTU provides an internal bit error rate tester (BERT) for the injection and observation of a pseudo-random bit sequence (PRBS) to and from the SHDSL interface on a per service basis. The BERT runs only one test at a time. When the NTU is injecting PRBS, all ones will be transmitted to the applicable G.703 or Nx64K port for that service. The NTU BERT provides the following ITU-T O.150 and O.151 compliant PRBS patterns:

- ALT
- 2047
- 2E15-1
- QRSS

The observation of data on a service under test commences automatically when BERT test is started. The following statistics will be available on the VT100 screens and by EOC response message when polled by NMS:

- Bit Error Rate (of format from 0.00x10E-0 to 9.99x10E-9)
- Bit Error Count (the number of bit errors during the test period)
- Pattern Sync Loss Count (the number of times a PRBS pattern sync has been lost during the test period)
- Errored Seconds (a second that contains one or more PRBS bit errors)
- Outage Seconds (a count of 10 or more consecutive Error Seconds - No outage is when one second occurs with no errors)
- Total Elapsed Time (of format DD:HH:MM:SS)
- BERT Status
 - On
 - Off

Table 14. Loopback Test Summary

Initiating Source	SHDSL Port	G.703 Port	G.703 Service	Nx64k Port/ Service
NMS				
Proprietary EOC Local Loopback Request Message ACTIVATE (Initiates one of five loopback types, regardless of the associated Loopback Type Option setting.)				
Proprietary EOC Local Loopback Request Message DEACTIVATE				
Proprietary EOC Remote Inband Request Message ACTIVATE (Initiates a Remote Loopback per the remote unit's associated port/service Loopback Type option setting, if supported, and in the direction of signal origination.)	N/A	N/A	Sends Inband Signal	Sends Inband Signal
Proprietary EOC Remote Inband Request Message DEACTIVATE	N/A	N/A		
VT100 Test Screen				
VT100 Local Loopback ON (Initiates one of five loopback types, regardless of the associated Loopback Type Option setting.)				
VT100 Local Loopback OFF				
VT100 Remote Inband Loopback ON¹ (Initiates a Remote Loopback per the remote unit's associated port/service Loopback Type option setting, if supported, and in the direction of signal origination.)	N/A	N/A	Sends Inband Signal	Sends Inband Signal
VT100 Remote Inband Loopback OFF	N/A	N/A		

Table 14. Loopback Test Summary (Continued)

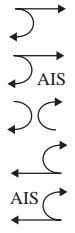









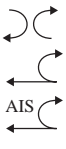



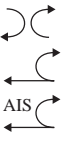

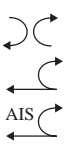


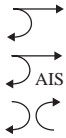



Initiating Source	SHDSL Port	G.703 Port	G.703 Service	Nx64k Port/ Service
VT100 Remote Loopback ON¹ (Initiates a Remote Loopback using proprietary EOC request messages, regardless of remote unit's associated Loopback Type Option setting.) ²	Single proprietary -ary ECO request message 	N/A	N/A	N/A
VT100 Remote Loopback OFF		N/A	N/A	N/A
Front Panel Pushbuttons				
Local Loop Pushbutton ON (Initiates a Local Loopback per the associated port/service Loopback Type Option setting.)		N/A	Single Service Only 	
Local Loop Pushbutton OFF		N/A		
Remote Loop Pushbutton ON (Initiates a SHDSL Port Dual Sided Remote Loopback; or a G.703 Single Service or Nx64K Service Remote Loopback per the remote unit's associated service Loopback Type option setting, if supported, and in the direction of signal origination.)	Sends Standard EOC Request Message 	N/A	Single Service Only, Sends Inband Signal 	Sends Inband Signal 
Remote Loop Pushbutton OFF		N/A		
LL (Circuit 141) ON (Initiates a Local Nx64K Loopback per the Nx64K Port Loopback Type option setting.)	N/A	N/A	N/A	
LL (Circuit 141) OFF	N/A	N/A	N/A	
RL (Circuit 140) ON (Initiates a Remote Loopback by sending an inband signal. The remote unit implements a Nx64K service loopback per its Nx64K Loopback Type option setting, if supported, and in the direction of signal origination.) ¹	N/A	N/A	N/A	Sends Inband Signal 
RL (Circuit 140) OFF	N/A	N/A	N/A	















Table 14. Loopback Test Summary (Continued)

Initiating Source	SHDSL Port	G.703 Port	G.703 Service	Nx64k Port/ Service
Inband Signal Reception				
Receive Inband Preparatory Signal (Initiates a Local Loopback per the associated service Loopback Type option setting, and in the direction of signal origination.)	N/A	N/A		
Receive Inband Termination Signal	N/A	N/A	N/A	
ISDN PRA V3 Reception				
Receive V3 Loopback Bit ON (Initiates a Local Loopback per the G.703 Port Loopback Type option setting, and in the direction of V3 signal origination.)	N/A		N/A	N/A
Receive V3 Loopback Bit Off	N/A		N/A	N/A

¹ The reception of inband patterns and EOC loopback request messages may be ignored or blocked on certain Total Access 3000.

² If connected to a remote unit that does not support the EOC proprietary message spec, then only the EOC standard Customer and Network Loopback request bits are used. When either the Customer or Network Loopback bit is set, the remote unit determines which loopback type that it implements (i.e. transparent or non-transparent).

Table 15. KEY to Symbols used in Table 14

Directions	Loopbacks		
		No Loop	
If an NTU:			
 Network (toward the LTU)	 Network Transparent	 Customer Transparent	
 Customer (toward the NTU)	 Network Non-Transparent	 Customer Non-Transparent	
If an LTU:			
 Customer (toward the NTU)	 Customer Transparent	 Network Transparent	
 Network (toward the LTU)	 Customer Non-Transparent	 Network Non-Transparent	

Searching for pattern

The SHDSL 2W4W NTU will be able to reset the BERT counters when requested to do so by an NMS or VT100 test screen. Injection of a single bit error from the NMS, VT100 test screen, or front panel BERT pushbutton is also possible.

BERT Application

In a typical testing scenario, a remote loopback or remote BERT is active in conjunction with the locally active BERT, as depicted in [Figure 15](#) and [Figure 16](#).

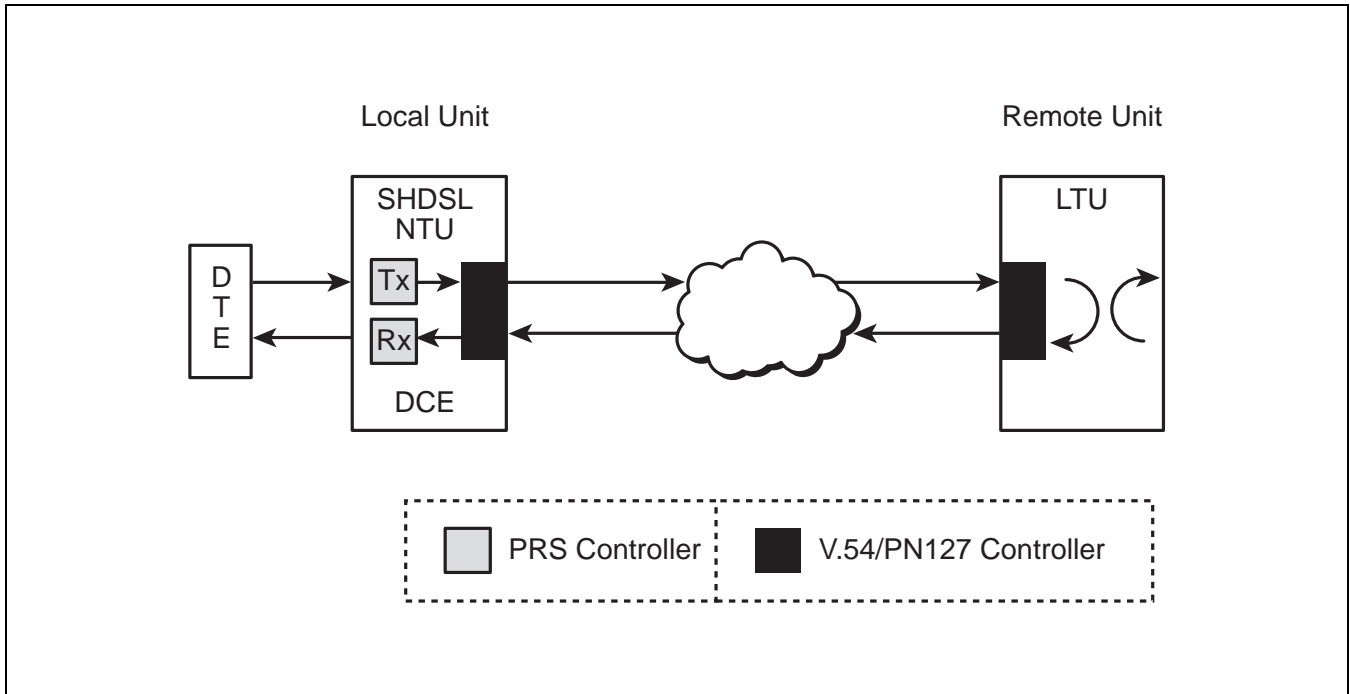


Figure 15. BERT and Remote Loopback

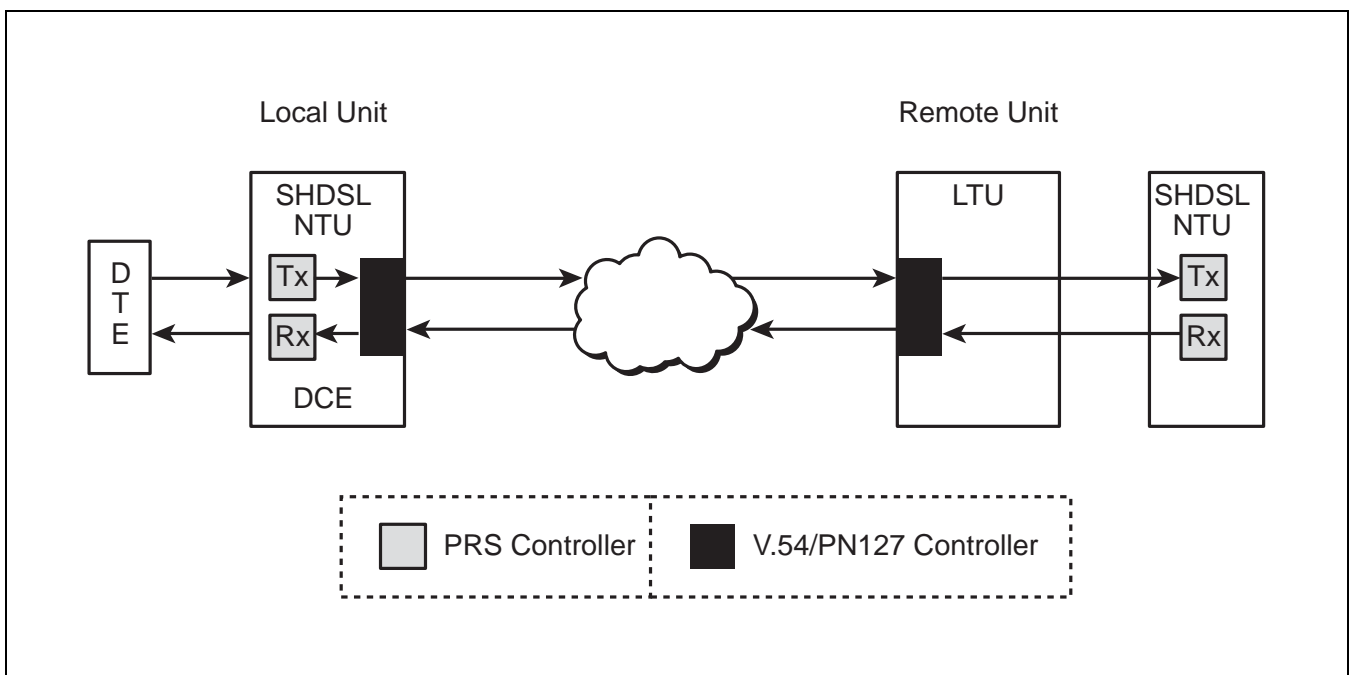


Figure 16. BERT with Remote BERT

6. SPECIFICATIONS

Specifications for the SHDSL 2-Wire/4-Wire NTU Product Series are detailed in [Table 16](#).

Table 16. SHDSL 2-Wire/4-Wire NTU Product Series Specifications

Environmental	
Operating Temperature:	-40°C to 65°C
Storage Temperature:	-40°C to 85°C
Relative Humidity:	95 percent maximum @ 50°C, noncondensing
Maximum Current Draw:	0.025 A maximum @ -48VDC
Maximum Heat Dissipation:	1.21 watts
Physical	
Dimensions:	3.125 in. H x 1.14 in. W x 10.1 in. D
Weight:	< 1 lb.
Part Number	
SHDSL 2W/4W NTU, AC powered:	1230001L1
SHDSL 2W/4W NTU: DC powered:	1230002L1
SHDSL 2W/4W NTU:AC powered:	1230007L1
SHDSL 2W/4W NTU: DC powered:	1230008L1
SHDSL 2W/4W NTU: Span or DC Powered:	1230009L1

7. WARRANTY AND CUSTOMER SERVICE

ADTRAN will replace or repair this product within the warranty period if it does not meet its published specifications or fails while in service. Warranty information can be found at www.adtran.com/warranty.

U.S. and Canada customers can also receive a copy of the warranty via ADTRAN's toll-free faxback server at 877-457-5007.

- Request document 414 for the *U.S. and Canada Carrier Networks Equipment Warranty*.
- Request document 901 for the *U.S. and Canada Enterprise Networks Equipment Warranty*.

Refer to the following subsections for sales, support, Customer and Product Service (CAPS) requests, or further information.

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800-827-0807

ADTRAN Technical Support

Pre-Sales Applications/Post-Sales Technical Assistance:

800-726-8663

Standard hours: Monday - Friday, 7 a.m. - 7 p.m. CST
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ADTRAN Repair/CAPS

Return for Repair/Upgrade:
(256) 963-8722

Repair and Return Address

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901 Explorer Boulevard
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